The Need for Speed
The Vast Potential of High Speed Networks By John Fleischman Excerpt from Converge Magazine, Issue 1, Vol.I

Each year, California State Parks host more than 600,000 students taking field trips to learn about California's rich ecological systems. But in recent years the demands of meeting state standards, coupled with increasing economic barriers, have prevented some schools from conducting field trips to the parks. Using the California K-12 High Speed Network, students are now able to conduct real-time virtual visits to selected State Parks. (...continued below ad)

Via the Missouri Research and Education Network (MOREnet), students access a wide array of high-quality digital content, learning communities, and specialized programs and services. One of MOREnet's efforts includes the creation of media content related to the Lewis and Clark expedition. Using these online resources, students throughout the United States are now able to participate in the national bicentennial commemoration of Lewis and Clark's 1803 to 1806 expedition.

In the state of Washington, thousands of elementary and secondary students access online courses, technology tools, and an array of digital media delivered via the Washington Digital Learning Commons.
Student learning experiences are enhanced significantly when these electronic learning resources are delivered via the Washington State K-20 Educational Telecommunications Network.

Each of these network-based instructional resources relies on fast K-12 educational networks, often built in partnership with institutes of higher education. In fact, 34 states now offer K-12/K-20 networks through sponsorship by university Internet2 members. How are these networks structured? Why are these networks important and what are the implications for K-12 education? In a world that is constantly shrinking, one where information and knowledge is the new gold standard, high-speed networks offer significant possibilities for enhancing and extending teaching and learning.

Internet and Internet2

The commercial Internet continues to grow and expand at a significant rate. According to a recent Harris Interactive survey, three-quarters of Americans now go online, with the number of hours spent online averaging
12.5 hours per week. Of greater interest is recent Nielsen NetRatings that indicate broadband (DSL and cable "modems") has surpassed dial-up connectivity, reaching 61 percent of residential Web users.

The early Internet of the 1970s included thousands of users, remote logins and somewhat rudimentary methods for accessing information. The network itself was a system of circuits connected to mainframe computers. Some years later, with the advent of

hypertext transfer protocol (HTTP), the Internet evolved more rapidly to include huge segments of our population.

Today's Internet is comprised of interconnected computer servers and personal computers. It includes millions of users who rely on the existing network for e-mail, interactive text and media resources, and an evolving commercial and entertainment structure of immense proportions.

Many educators complain the commercial Internet doesn't offer reliable end-to-end performance critical for widespread adoption and implementation. That lack of reliability was one of the primary reasons
Internet2 came into existence.

Internet2 is a research and development consortium led by more than 200 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies. The
Internet2 community includes over 70 companies and more than 40 affiliated organizations. Internet2 member agencies are working with more than 30 other similar research and education networking organizations in countries around the world. The primary goal of the
Internet2 community is to enable a new generation of network applications via the creation of a leading edge network for research and education.

At the core of Internet2 is the Abilene Network, an OC-192c (10 Gbps) backbone employing optical transport technology and advanced high-performance routers. Abilene, created by the Internet2 community, connects regional network aggregation points -- called gigaPoPs -- to over 220 Internet2 university, corporate, and affiliated member institutions in all 50 states. Developing parallel to the Abilene Network is the National LambdaRail (NLR), a major initiative of U.S.
research universities and private sector technology companies. When complete, this Internet2 partner project will manage the largest higher-education owned and managed optical network.

It is important to understand that Internet2 is not designed to replace the commercial Internet. Internet2 offers a separate and much more efficient pathway to send information. This efficiency decreases time to access information while simultaneously increasing security.

A National, State and Local Perspective

In early 2001, the Internet2 community decided to extend access to the broader educational community. The approach to expand connectivity evolved into a process called Sponsored Education Group Participants (SEGPs). The SEGP program is intended to allow expanded access to Abilene for state and regional education networks through sponsorship by

Internet2 university members. State and regional networks include primarily nonprofit and for-profit K-20 educational institutions, museums and libraries. Today there are 34 state K-12/K-20 participating networks.

One example of a successful SEGP relationship is California's higher education network, known as the California Research and Education Network (CalREN) and operated by the nonprofit Corporation for Education Network Initiatives in California (CENIC). The California K-12 community is actually one of four public education segments that participate in the larger state-funded K-20 connectivity initiative. Each of these segments relies on the CalREN network for access to the commercial Internet and to Internet2.

The K-12 component of CalREN is known as the California K-12 High Speed Network (K12HSN). This state-funded program is designed to facilitate participation by all California K-12 school districts and schools. As of April 2005, K12HSN data showed that 7,039 schools (74 percent), 887 districts (89 percent), and all 58 county offices of education were connected to the network. These figures represent access for almost 4.8 million California students! At the core of the K12HSN network is a backbone of 72 K-12 nodes sites, mostly comprised of county offices of education.

Throughout California, county offices of education and school districts incorporated creative methods to extend the national (Abilene) and state
(CalREN) networks. For example, in Sacramento the K-20 educational community leveraged the local cable TV franchise process. Cable TV companies doing business in Sacramento are required to provide dark fiber assets for use by the educational community. Using this fiber, the Sacramento County Office of Education has developed a Gigabit Ethernet network connecting a majority of the school districts. That network, in turn, is connected to the Sacramento node and hub sites operated by K12HSN/CalREN.

Broadband for Teaching and Learning

Broadband content is difficult to define and even more challenging to quantify or categorize. Nevertheless, there do seem to be clear trends with respect to what K-12 institutions are using. Clearly one of the most used broadband applications is Internet Protocol (IP) based video.
This includes streaming video, video-on-demand, webcasting, and videoconferencing. Other applications used on high-speed networks include digital repositories or libraries (using primary reference material), online multimedia courses, access to remote instrumentation, and a wide variety of real-time collaboration or virtual learning tools. Learners often use broadband content and resources to create new knowledge and new opportunities, and to access national and international learning communities. Following is a sampling of several
K-12 broadband resources.

Examples of K-12 Broadband Resources

California State Parks
An excellent example of engaging learners via high-speed networks is happening with the Parks Online Resources for Teachers and Students (PORTS), a program of the California State Parks. PORTS was devised as an alternative approach to conducting in-person field trips and uses the high bandwidth of the K12HSN/CalREN network to deliver units of study to classrooms around the state. Using interactive videoconferencing tools, PORTS now connects students to park rangers and CA State Parks in real time over great distances.

Lewis and Clark's Journey
In 2006, the United States will commemorate the bicentennial of the Corps of Discovery's historic journey across America. Using the capacity of Missouri's educational network,MORENet, students are following various re-enactment groups as they retrace the three-year voyage of the Corps of Discovery. Using the power of Internet2, and videoconferencing technology coupled with media rich Web sites, students in classrooms nationwide are actively engaged in retracing Lewis and Clark's journey to understand how it shaped America.

Students Communicating Worldwide
Megaconference Jr. is an annual project designed to promote cultural awareness and also raise the technology understanding of students in the
K-12 environment. Students from around the world design and coordinate videoconferences to discuss issues of interest in their everyday lives.
On May 18, 2006, Megaconference Jr. will host the third annual conference. The conference is a fascinating forum that addresses multiple subject areas and helps students and teachers understand and utilize high-speed networks.

Adventures in Science
The JASON Project is an interdisciplinary program based on the National Science and Geography Standards. The JASON Project integrates video programming, satellite transmissions, classroom activities and instruction, and offers extensive online opportunities that expose students to real science and exploration. Through a hands-on, inquiry-driven learning experience that includes a live two-week satellite expedition, JASON inspires teachers to try new teaching techniques and effectively engages students in active learning.

During the past several years, JASON Project staff have experimented using Internet2 to transmit real-time content directly to students'
desktops.

The K-20 Initiative

A useful Web resource for learning more about existing applications being used on high-speed networks is the Internet2 K-20 Initiative. The goal of the K-20 Initiative is to bring together various education sectors to enhance teaching and learning via high-speed networks. The K-20 Advisory and Executive Committees facilitate projects that explore

ways advanced network applications extend access to education and educational resources. On the Internet2 K-20 Web site you'll find a database of projects, people and the latest national connectivity surveys.

HSN's Endangered Future

Many states are struggling with securing adequate funding to build and expand their K-12 and K-20 high-speed networks. In California, the Legislature is debating continued funding for the K12HSN. While many educators understand and embrace the potential of this powerful tool, some legislators ask questions like, "Why can't you use the 'regular' Internet?" and "Show me how this fast network increases test scores."

In California, based on economic reasons alone, it makes good sense to provide a statewide high-speed network. Last year, nearly $5 million was saved on commercial Internet costs (based on a comparison of the K12HSN/CalREN to similar network services provided under a California state purchase program). Additional economic benefits include: vastly improved end-to-end connectivity, centralized networking monitoring services, peering of networks to reduce commodity Internet traffic costs, videoconference coordination and support, and quality of service (QoS) for mission critical instructional applications.

Most new educational technology tools require time to identify or create appropriate learning resources, to train teachers and to integrate the technology into ongoing programs. But unlike other new educational technologies, high-speed networks serve as an enabling infrastructure.
And this infrastructure has an important place in the future of education as a very powerful and important tool for creating distributed learning environment.